

Nuclear Two-Photon Decay Investigation Of ^{98}Mo At The ESR Heavy Ion Storage Ring

Dienstag, 19. August 2025 10:00 (30 Minuten)

The nuclear two-photon or double gamma (2γ) decay is a rare second-order electromagnetic process in which an excited nucleus emits two gamma rays simultaneously [1]. Its branching ratio is significantly lower than that of competing first-order processes such as internal conversion, pair creation, or single-photon emission, making its experimental observation extremely challenging. However, in the Experimental Storage Ring (ESR) at GSI, these competing decay modes can be suppressed by storing fully stripped ions and selecting a $0^+ \rightarrow 0^+$ transition with excitation energy below the electron-positron pair creation threshold (1022 keV) [2, 3]. Under these conditions, the two-photon decay becomes the only available decay channel.

In this talk, we will report on the current status of the analysis of an experiment investigating the 2γ decay of ^{98}Mo , which has a first excited 0^+ state at 734.75 keV. The experiment was performed at the GSI facility in Darmstadt, employing the unique conditions in the Experimental Storage Ring. Fully stripped ^{98}Mo ions were produced using the projectile fragmentation of ^{100}Mo primary beam on a ^9Be target in the transfer line to the ESR. These ions were then transported and stored in the ESR, which was operated in the isochronous mode. To monitor and detect the revolving ions, two non-destructive Schottky detectors [4] were used at different operation frequencies (245 and 410 Hz). These detectors allow for precision measurement of the ions' revolution frequencies, enabling extraction of both the nuclear half-life and mass. In addition, the revolution frequency provides particle identification via the ions' mass-to-charge ratios. The preliminary results indicate that the measured half-life of ^{98}Mo is consistent with the expected theoretical estimates based on extrapolation from previously studied $0^+ \rightarrow 0^+$ nuclear transitions [1].

References

- 1) J. Kramp et al., Nucl. Phys. 474, 412 (1987).
- 2) Yu. A. Litvinov, W. Korten, EPJA 233, 1191 (2024).
- 3) D. Freire Fernández et al., Phys. Rev. Lett. 133, 022502 (2024).
- 4) M. S. Sanjari et al., Phys. Scr. 2013, 014088 (2013).

Autor: FORCONI, Carlo (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Co-Autoren: CHEN, Rui Jiu (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); FREIRE FERNÁNDEZ, David (MPIK, GSI, CEA); KORTEN, Wolfram (CEA Paris-Saclay); LITVINOV, Yury (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); MENZ, Esther Babette (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); SANJARI, Shahab (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); SIDHU, Ragan-deep Singh (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); AHMED, Usama (Institute for nuclear physics, TU Darmstadt); AKINCI, Fatma Cagla; ARMSTRONG, Michael (University of Cologne); BARDAK, Jelena (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); BERTHELOT, Camille (Centre d'Etudes Nucleaires de Bordeaux Gradignan (CENBG)(CENBG)); BORMANS, Jeroen (Technische Universität Darmstadt(TUDA-IKDA)); DILLMANN, Iris (Tri-University Meson Facility (TRIUMF)(TRIUMF)); DELLMANN, Sophia Florence (Goethe-Universität Frankfurt(Uffm-IAP)); FORSTNER, Oliver; GLORIUS, Jan (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); GORSKA-OTT, Magdalena (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); GRIFFIN, Chris (TRIUMF); GUMBERIDZE, Alexandre (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); HARAYAMA, Sakumi (RIKEN); HESS, Regina (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); IDE, Katharina (IKP TU Darmstadt); HUBBARD, Nicolas James (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); JURADO, Beatriz (CENBG); KALAYDJIEVA, Desislava (University of Guelph); KANIKA, Kanika; KIKUCHI, Yuma (RIKEN); KONDEV, Filip; KOSIR, Gregor (GSI); LARSSON, Johan Emil Linnestad (Technische Universität(TUDA)); LI, Hongfu (IMP); LITVINOV, Sergey (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); LORENTZ, Bernd (Forschungszentrum Jülich); MAYR, Hannes (IKP TU Darmstadt); NUNNS, Zachary (University of Surrey(USU)); OHNISHI, Tetsuya (RIKEN); PODOLYAK, Zsolt (???); STECK, Markus (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); TAKIURA, Kazuki (Saitama); VESIC, Jelena (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); WEICK, Helmut (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); WEIN-

ERT, Michael (University of Cologne); WLOCH, Boguslaw (Henryk Niewodniczanski Institute of Nuclear Physics (IFJ)(IFJ)); XING, Yuanming (GSI, Darmstadt); XU, XING (Institute of Modern Physics, CAS); YAMAGUCHI, Yoshitaka (RIKEN Nishina Center); YANO, Asaho (RIKEN); YAMAGUCHI, Takayuki (Saitama University(SAITAMA)); ZHANG, Min (IMPCAS); YAN, Xinliang (IMPCAS, China); ZHANG, Yuhu (Institute of Modern Physics, Chinese Academy of Sciences); ZHOU, Xu (IMPCAS); ZIDAROVA, Radostina (IKP, TU Darmstadt)

Vortragende(r): FORCONI, Carlo (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))